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Metal-containing diamond like carbon (a-C:H:Me) as a functional coating for metallic bipolar plates "DiaPolar"

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Redox Flow Batteries, (RFB) have been used in large scale applications and are a proven technology. With efficiencies as high as 80% and long life cycles they offer a unique way to store energy. The principle of the RFB is that the energy is stored in two fluid electrolytes containing metal ions which can then be converted into electrical energy. When the energy in the electrolytes is spent, the tanks can be drained and replaced with a new electrolyte, and the spent electrolyte re-energised. This is the advantage of RFB over commonly used Lithium-ion batteries which take hours to recharge. In order to make this technology more affordable and compact, new approaches to this technology must be investigated.
The aim of this project is to find an optimum bipolar plate which can be manufactured inexpensively, has both a high mechanical strength and corrosion resistance capable of withstanding the sulphuric acid used in the cell. This will be achieved by researching various a-C:H:Me coatings, (chrome, titanium, tungsten and vanadium) on different substrate material samples such as stainless steel, titanium and aluminium alloys. Variation in the a-C:H:Me coatings such as thickness and metal percentage will also be investigated to find the optimum combination.
The characterisation of the samples will be ascertained by both, Fraunhofer IST in Braunschweig and Fraunhofer ICT in Wolfsburg. The samples will need to show long term stability in the acidic environment present in the fuel cell, in addition to a good coating adhesion and low defect rate. Also, the coating must be within the necessary RFB parameters, in a potential range of -0.26 volts to +1 volts. Finally a prototype will be built to compare the new RFB with the a-C:H:Me coating and electrode material to the commonly used graphite Electrodes.

Keywords
Redox Flow Battery
Bipolar plate
Corrosion Resistance